The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

BOUVERIE HOUSE, 154, FLEET STREET, LONDON, E.C.4

Telegrams: ALLANGAS FLEET LONDON
Telephone: CENTRAL 3212 (10 lines)
GLASGOW: 116, Hope Street (Central 3970)
BIRMINGHAM: Daimler House, Paradise Street (Midland 0784-5)
THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers, Limited

VOL. XLIV. NO. 1143 May 24, 1941 Annual Subscription, 21s. Overseas, 26s.

Research in Canada

GREAT significance must be attached to the fact that Lieut.-General A. G. L. McNaughton, C.B., C.M.G., D.S.O., combines the two positions of G.O.C. 1st Canadian Corps, Overseas Force, and President of the National Research Council of Canada. A few years ago such a combination would have been wildly improbable, if not impossible, and its existence to-day gives some indication of the importance, official and national, with which scientific research is at long last regarded.

The course of research in Canada, as revealed by General McNaughton in a brilliant and informative lecture before the Royal Society of Arts, closely resembles that of research in Britain. Up to 1914 "pure" research was left to the universities and its results became available to all, friend and foe alike; "industrial" research, on the other hand, was a matter of "trade secrets," jealously guarded from competitors, but not necessarily from associated concerns abroad. The result was the lamentable position with which this country, and Canada too, were faced at the outbreak of war in 1914—a period when even our gun-sights were made of imported optical glass, as the lecturer pointed out. Enough has been said in our columns of the events that led up to that state of affairs and of the heroic and, happily, successful efforts which our scientists made to deal with the situation. Contrasting with this was the position in Germany, where research had long been recognised as a matter of profound concern and where its organisation and correlation had been taken under the auspices of the Government. Groups of trained scientists developed every idea and invention, and their developments were exploited by eager men of business—to such an extent that Germany held a virtual monopoly in such important directions as the dye industry and the optical glass industry.

However, *fas est ab hoste docere*, and the inherent initiative of British industrialists and the skill of British workmen remained as an unwasted asset. Leeway was made up and Government laid a firm foundation for the future by the establishment of the Department for Scientific and Industrial Research. Canada followed suit with the setting up in 1916 of the Honorary Advisory Council for Scientific and Industrial Research. An account of the progress of this body and its successor, the National Research Council, formed the latter part of General McNaughton's lecture, and a very fascinating story it makes.

True to imperial tradition, facilities at first were very limited. The Council was envisaged as a purely advisory body; its annual expenditure for research in Dominion and Provincial laboratories was less than $100,000; and of some 2400 leading firms who replied to a circulated questionnaire, only 37 had laboratories that even pretended to engage in research. The pressure of informed public opinion, however, at last bore fruit: in 1924 the Research Council Act was passed; in 1930 the Council's main laboratories were founded at the junction of the Ottawa and Rideau rivers; and in 1932 they were opened. By no means all the difficulties were now overcome, however. The ascendancy of the "Geneva school of thought" made it dangerous to admit that some of the research work in hand might conceivably be of advantage to a programme of defence, and adequate funds for research, either on the vital needs of competitive industry or on the co-ordination of the work as a potential war-time measure, came only very slowly. In 1935, however, the Government saw fit not only to double the current annual appropriation, but to provide substantial capital sums to complete the equipment of the laboratories, and these increased appropriations were maintained until by 1939 the budget of the N.R.C. was something over $1,000,000.

Parallel with this official development, and doubtless encouraged thereby, Canadian industry had not been unmindful of research. The 37 research laboratories of 1916 had grown into 1000; the Ontario Research Foundation was established; and at the same time various Dominion Departments set up research organisations of their own. Readers of our news columns will have assured themselves that these developments are very far from being stationary.

At all events, as General McNaughton pointed out, the position at the beginning of the present war was that Canada possessed, in physical existence, well-staffed laboratories competent to act as a nucleus in undertaking the study of the problems presented in almost every field of war requirements, as well as in the industrial life of the country as it had to be reoriented to produce the vast and complicated supplies needed in transition from a peace to a war basis. But the adequacy of physical equipment and technical staff is only one side of the question, and what is probably equally important as an asset is the organisation of the Council itself as a going concern and the intimate relations that had been developed with every branch of science in Canada. One of the great advantages possessed by a comprehensive organisation such as the Council's own laboratories is that experts in every line required can be brought together at short notice to

study a problem and to work as a team for its solution. This facility is very important, for students of most research problems related to industrial or agricultural production or processing are usually confronted with limiting factors of many kinds and it is not easy in advance to determine in which branch of science the answer should be sought. To attain this end a number of so-called "associate committees" have been set up with the special objective of directing co-operation and correlation in research. Investigations which they recommend are conducted in laboratories of all kinds throughout the Dominion, and much of the initiative of these committees lies with the experts from other organisations who have associated themselves with the Council. The N.R.C. likewise interests itself in assisted research and in the award of scholarships, and it officially encourages research in universities and kindred institutions.

There has never been any attempt on the part of the N.R.C. to monopolise research; on the contrary it has long been realised that for the safety of the nation against peace-time industrial competition, let alone to meet the need of war, it is impossible to have too much research. In Canada the difficulties are particularly acute for, as is well known, most of the principal industrial companies there have affiliations with larger organisations abroad to whom there has been a natural tendency to refer any research problems that arise from time to time. It is often very difficult to examine these problems exhaustively away from the special environment in which they have come to attention and the solutions proposed are often, therefore, inadequate, and, both on this ground and on account of delays, very heavy losses are involved. A more serious loss is due to the fact that without a corps of trained investigators on the spot, the needs of the situation are not fully appreciated and many opportunities for useful inventions and developments are missed or unduly delayed.

General McNaughton concluded his lecture with a necessarily brief account of war-time researches in Canada. Even the developments he was able to mention, however, form a most reassuring catalogue of the mighty assistance that the Dominion is giving to the imperial war effort. In conclusion we cannot do better than quote a telling sentence from his opening paragraphs: "I would affirm," he said, "the far-reaching importance of research to all and assert that, save for the high quality, great vision, and determined perseverance of British Science, backed by British Industry, and the substantial measure of success which has already been achieved in the search for methods and apparatus to beat the enemy's attacks by sea and by air, our meeting here to-day might not have been possible at all."

NOTES AND COMMENTS

High-Grade Coke from Low-Grade Coal

SOVIET scientists are reported to be working out a new method for the industrial production of high-grade coke for smelting purposes from low-grade coal. A commission, headed by Professor M. A. Pavlov, has carried out experiments at the Magnitogorsk Iron and Steel Works in the Urals with low-grade coal from the deposits in the east and south Russia. From data collected by this commission an apparatus has been designed for determining the behaviour of coke in the blast furnace. The device further makes it possible to control the process of smelting, to increase the productivity of blast furnaces, and to improve the quality of coke. Coke obtained from low-grade coal deposits has been successfully tested in blast furnaces, making it practicable for the Magnitogorsk Works to use coal from the Karaganda basin in Kazakhstan, 620 miles nearer than its present source of supply.

Chemistry in the Forest

INVESTIGATIONS into the use of chemical means of controlling cockchafer damage to trees are the subject of comment in the recently issued annual report of the Imperial Forestry Institute for 1939-40. Some of the experiments, which were of a preliminary character and under the direction of Mr. J. M. B. Brown, assistant entomologist, were carried out at Kennington Nursery, near Oxford, with the aim of testing the poisonous effect on nursery plants of the various chemicals used, together with their insecticidal effect on chafer larvae. Eight different substances were employed and the experiments clearly established which of these could not safely be used against grubs without risk to the plants. The treatment of chafer-infested turf with paradichlorobenzene and carbon disulphide was the subject of experiments at Perch Nursery in the Forest of Dean and encouraging results were obtained. Further tests at Nagshead Nursery, in the New Forest, reinforced the conclusion, previously reached, that serious losses of nursery stock can be greatly minimised by cultural methods. At the same time, it is felt that satisfactory control of the cockchafer pest will never be obtained without a reliable soil fumigant and a cheap and effective deterrent to egg-laying. It is understood that in subsequent soil-fumigation tests really promising results have so far been obtained with carbon disulphide and paradichlorobenzene, and in consequence more detailed tests are now being undertaken. Two other chemicals regarded as meriting further experimental work in this connection are acetic acid and lead arsenate (otherwise "Paris Green"). The latter is extensively used in the U.S.A. against Japanese Beetle grubs. As a surface dressing at the time of beetle flight, to deter egg-laying females, naphthalene has given positive results, but it is considered to be of little use as a larvicide. The report further states that research work has shown that by using organic composts it is possible to raise on heath and moorland sites planting stock of pines better from the mycorrhizal equipment point of view than in the regular forest nurseries. The preparation of produce, mainly from thinnings in Bagley Wood, has been carried out on an extensive scale, including the preparation of charcoal in portable iron kilns.

Learning in the Levant

WITHOUT long tradition to grace its halls, the University of Jerusalem is rapidly expanding. It has entered upon its sixteenth year with 1100 students and an academic staff of 150, a third of whom are refugee scholars. Jewish Palestinians are joining the University in larger numbers than before the war, for they cannot turn to Europe for higher learning and among the undergraduates are a small number of Arabs. There are three Faculties, says the *Manchester Guardian*, instructing respectively in the Humanities, in Mathematical Sciences, and in Agriculture, and a Pre-faculty of Medicine. Many of the students have enrolled in the British forces; and in other directions the University is taking no evasive view of the war, nor failing to grapple with the problems connected with it, as they affect Palestine. The agricultural and chemical departments are facing a thorny situation created by the fact that the country is cut off from exports. Oranges, for instance cannot be exported nor fodder

TABLE OF CONTENTS *appears on page* 300

imported. The University has accordingly devised a way in which the dried fruit may provide the animals with their fodder. It may well be that the laboratories, research equipment, and scientists will prove of inestimable worth to the Allies during the fight in the Levant, nor, when peace comes, will it be any less valuable to know that the University of Jerusalem is ready to take undergraduates from the ravished lands of South-East Europe.

Cheaper Sulphanilamide

A METHOD of synthesising sulphanilamide with only half as many steps as have hitherto been required has been developed at the Mellon Institute of Industrial Research, Pittsburgh (U.S.P. 2,237,372, to J. K. Simons). Besides cutting down the number of steps the new method starts with a cheaper chemical. Until now the starting material has been aniline, which required four separate operations to be converted into sulphanilamide. This has been reduced to two by employing, in the new synthesis, chlorobenzene, which costs only two-thirds as much as aniline. The first step involves treating the chlorobenzene with sulphonyl chloride. In the second step the reaction product of the first operation is heated at a temperature of 150° C. with aqueous ammonia in the presence of a copper catalyst. The Plaskon Co. of Toledo, Ohio, has bought the patent.

Notes from Works Safety Jottings

Dangers of "Harmless" Materials

by JOHN CREEVEY

FERRO-SILICON, which is merely an alloy of iron and silicon, would not normally be regarded as a dangerous material; nevertheless, several years ago a bargeman in Holland died on board a lighter which was carrying this as a cargo, and his death was found to be due to poisonous gases arising from the alloy. Investigations showed that the poisonous gases were phosphine and arsine, and that both were evolved when the ferro-silicon came in contact with water or moist air. Further experiments showed that the gases were evolved only from samples of the alloy containing more than 25 per cent. silicon, unless other metals such as manganese or aluminium were also present as impurities; with a silicon content of 40 to 60 per cent. the alloy disintegrated spontaneously, and the evolution of poisonous gases increased to such an extent that transport or storage was likely to become dangerous. Almost identical circumstances were present at a metal refinery in England a year or so later, where, but for the timely detection of the presence of poisonous gases, there might have been several fatalities. In both cases the material handled was merely "ferro-silicon."

* * *

When considering the so-called "dangerous" nature of a material as regards transport or storage, certain circumstances have to be taken into account. Carrying a cargo of ferro-silicon by water transport necessarily involves some risk of contact with water in the absence of any special precautions, such as packing the material in waterproof containers. Ferro-silicon, however, is not looked upon as a dangerous material, and in the particular instance cited it was certainly not regarded as dangerous when in close proximity to water or air heavily laden with moisture. Exactly when a material, hitherto unsuspected, passes into the category of the "dangerous," on account of some recorded circumstances, is difficult to define, but there is no doubt that one single fatality, for which evidence is forthcoming as the result of subsequent experiments, should be ample to make the change and call for appropriate publicity.

* * *

In any schedule of chemical merchandise, the interpretation to be placed upon the word "dangerous" varies with the viewpoint taken by such different people as railway authorities, road transport contractors, shipowners, shipping agents, the man who does the stowing, and the insurance underwriter, not to mention the manufacturer and his client. Even the considered verdict of all interested parties is not the same in those countries where chemicals are constantly passing through. Fire-danger in terms of the flash-point of inflammable liquids provides an outstanding instance. In England liquids which have a flash-point below 23° C. are considered to be of "special danger"; those with a flash-point between 23° and 66° C. are classed as "less risky." In the United States there are "flammable" liquids with a flash-point under 27° C., and "combustible" liquids with flash-points between 27° C. and 66° C. But in Germany it was common to meet liquids "dangerous as regards fire" (flash-point under 21° C.), liquids "able to burn readily" (between 21° C. and 55° C.), those "able to burn" (55° to 100° C.), and those that "burn with difficulty" (flash-point above 100° C.).

* * *

A particular material, with a certain recognised element of danger as regards transport or storage, can become materially more dangerous by being in close proximity with other material, yet tolerably safe in normal circumstances by reason of the type of packaging adopted. It is when circumstances become abnormal, as by an actual outbreak of fire, or by water damage following an outbreak of fire, that the full extent of the "dangerous" nature of such materials comes to light.

* * *

Improper storage conditions, and also the storage of "incompatible" materials, have been the cause of many outbreaks of fire. The risk occurs mainly in warehouses and stores other than at the works of the manufacturer. On more than one occasion a serious fire has been traced to the breaking of a carboy of strong nitric acid within reach of straw and similar combustible materials. Straw will ignite within 35 to 45 minutes when in contact with nitric acid of sp. gr. 1.30 to 1.38; even weaker acid has been found to start a spontaneous outbreak of fire when the condition of the straw has been favourable. In these circumstances straw falls into the category of "dangerous" materials, quite apart from its combustible nature. So, too, do accumulations of old bags which have been used for the transport of such material as sodium nitrate or potassium chlorate, especially when there is risk of the bags getting damp and so spreading a small amount of residual nitrate or chlorate in finely divided form as they dry out.

* * *

Stocks of chemicals like sodium nitrate and potassium chlorate, among others, are not normally hazardous, but become extremely dangerous on the outbreak of fire. Becoming heated, they assist the general progress of the fire by providing oxygen. The problem of dealing with a fire under such circumstances is therefore made more difficult, and any attempt to apply the principle of smothering may prove futile. The application of water from a hose also offers difficulties, as there is a decided tendency to cause spattering and consequent spreading of the fire. Actually, it has been found that the best method of attack is to attempt to isolate the burning mass by application of a layer of fire-fighting foam, and then to effect extinction gradually while the burning mass is kept under control.

Dyestuffs in the Photographic Industries

Development of the Desensitiser

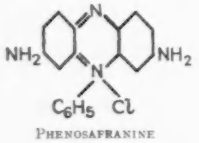
by G. S. RANSHAW

THE textile dyeing trade constitutes the largest market for the products of the dyestuff maker; nevertheless, a valuable auxiliary outlet is to be found in the photographic and cinematographic industries, where dyestuffs are used in limited quantities for various purposes. This may prove significant, since these industries have important war-time applications and interesting developments may be expected. These branches have progressed during the past few years largely owing to an increasing understanding of the use of dyes for the preparation of sensitised surfaces or for their treatment after exposure to light, elucidation of the particular constitution of the original dyes used enabling the photographic qualities of others of similar constitution to be predicted.

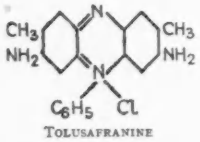
The applications of dyestuffs to photography may be grouped under a number of heads, all of which will not be dealt with here. They include the sensitisation and chromatic desensitisation of photographic emulsions to light, the lighting of laboratories where sensitised surfaces are manipulated, the preparation of anti-halo films, dyeing the silver image to modify or intensify its colour, complete substitution of a dye for the silver forming the photographic image, the use of dyes in colour photography, the employment of diazo colours for the sensitised surface of industrial reproduction papers (blue prints, dyeline, etc.), and the use of dyes in colour cinematography. From the point of view of the dyestuff chemist the most interesting development has been that of the chromatic desensitiser, and it is exclusively with this aspect that we are concerned here.

Chromatic Desensitisation

The function of the chromatic desensitiser is to diminish the sensitivity to light of silver-halide-containing emulsions, without affecting the latent image, thus permitting these emulsions to be manipulated under lighting conditions differing from those normally in service. They find their chief application in the manufacture of panchromatic emulsions, which can normally be manipulated only in complete obscurity. The first dyes used in practice for this purpose belonged to the quinone imine class, the relevant properties of phenosafranine being pointed out as early as 1921. To the class of colours derived from the above belong the azines, comprising the eurhodines and the safranines. Among the latter are phenosafranine, or diaminophenazine, and tolusafranine, or commercial safranine. These exercise a powerful desensitising action throughout the spectrum when employed in aqueous solution (dilution 1/2000), either in the form of a preliminary bath or added to the developer.



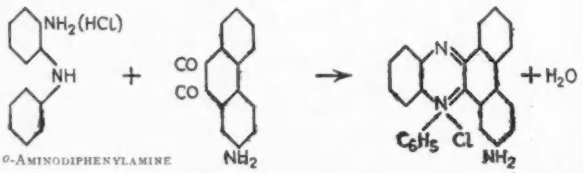
PHENOSAFRANINE



TOLUSAFRANINE

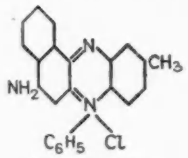
Safranine has the disadvantage in use that it stains the gelatine and the fingers; with the object of finding substances without this disadvantage, the desensitising properties of a large number of dyes of the azine class have been examined, but none has any marked advantage over phenosafranine. If the two amino groups of safranine are acetylated, thus diminishing the basicity, the resulting compounds are inactive. Similarly, if safranine is diazotised and coupled with different components, it loses its desensitising power. The replacement of an amino group by a hydroxyl (as in the safraninones) diminishes the property, while if two amino groups are replaced by two hydroxyl groups (as in the safranols) complete loss of desensitising power ensues. Homologues of phenosafranine in which the hydrogen of the amino groups is totally or partially replaced by CH_3—or C_2H_5—, have desensitising powers comparable with those of phenosafranine though they give rise to halation, but a series of isomeric safranines differing from ordinary safranine only in the position of the NH_2-group has been prepared and proved to make good desensitisers. The replacement of the benzene nucleus by naphthalene does not modify the property in question; the presence of two amino groups appears necessary, for, in aposafranine, which contains only one, desensitising power is only slight as compared with that of safranine.

Induline Scarlet, which belongs to the azine class, although containing only a single NH_2-group, is one of the most active desensitisers, but is more difficult to eliminate from the gelatine film than is phenosafranine. Certain derivatives of flavinduline have energetic desensitising properties. The most simple representatives arise by heating one molecule of o-aminodiphenylamine and one molecule of 2-aminophenanthraquinone. The initial compound of this series is a

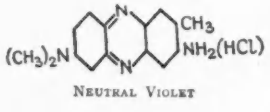


o-AMINODIPHENYLAMINE 2-AMINOPHENANTHRAQUINONE FLAVINDULINE

commercial dye with a limited textile use, but is different from photographic flavinduline in that the NH_2-group is absent. It is a feeble desensitiser and causes fog.



INDULINE SCARLET



NEUTRAL VIOLET

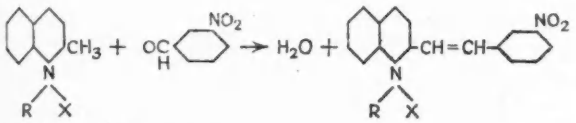
The Eurhodines

Those azines not having any substitution of the nucleus of the phenazine, such as Neutral Violet, are feeble desensitisers. The higher homologue of Neutral Violet has properties comparable with those of phenosafranine, but is a little less active, though easily removed from the gelatine. Active products are found also among other dyes derived from quinone imine, notably the indamines, indophenols, oxazines, and thiazoles, but these have little practical interest. The most interesting is methylene blue, belonging to the thiazine group, which is energetic enough but is somewhat discoloured by the alkaline sulphites of the developer and causes considerable halation.

The Pinakryptol Group

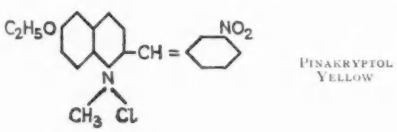
Marked progress in desensitisation was achieved only after the discovery of pinakryptol (Schulhoff). The first representative of the group was obtained by the introduction of an NO_2-group into pinaflavol, a *sensitiser* in the carbocyanine class. This introduces the subject of the close relation existing between the sensitisers and desensitisers and indicates the possibility of preparing new desensitisers from this group. Pinakryptol was the first colourless organic

desensitiser which could be used in solution. Schulhoff, employing *m*-nitro-*p*-dimethylaminobenzaldehyde in place of dimethylaminobenzaldehyde when preparing pinaflavol, and condensing it with the iodoethylate of α-picolene, obtained, in place of a sensitiser, a powerful desensitiser. In this condensation the dimethylbenzaldehyde can be replaced by nitrobenzaldehyde, and systematic study of the condensation products shows that the most active compounds are produced by the condensation of *m*-nitrobenzaldehyde with salts of either quinaldinium, β-naphthoquinaldinium, or 6-ethoxyquinaldinium. The typical reaction is as follows :—



Quinaldinium Salt — *m*-Nitrobenzaldehyde

Pinakryptol is a feeble yellow, its aqueous solution being almost colourless. Its solution is sensitive to light and must be preserved in the dark; it can be used only as a preliminary bath because the sulphite of the developer reduces it and it becomes inactive. Pinakryptol yellow is more stable and more soluble than the preceding in presence of the sulphite of the developer. It is obtained by the action of *p*-ethoxyquinaldine chloromethylate on *m*-nitrobenzaldehyde and corresponds to the following formula :—



Pinakryptol Yellow

The chloride may be replaced by the sulphate; the former exists in the form of yellow needles having a solubility in water of about 1 gm./litre. The solution is sensitive to light and must be kept in the dark. Addition of acetic or lactic acid improves its stability. For the purposes of practical photography, pinakryptol yellow can be considered one of the best desensitisers for panchromatic materials. If, however, the nitro group of the nitrobenzaldehyde is eliminated, a compound of very feeble desensitising power is obtained, while if replaced by NH_2 the power is completely destroyed. Thus the increase in the acid property of the aldehyde function is accompanied by an increase in desensitising power.

Those aldehydes containing an OH-group give rise to condensation products which are completely inactive, but which become useful *sensitisers* when the OH-groups are alkylated. Besides benzaldehyde, other aldehydes such as cinnamic aldehyde, nitrobenzaldehyde, and glyoxal give rise to substances having marked desensitising power. Several dyes of the pinakryptol series which do not contain nitrated groups in their molecule have good desensitising power. The introduction of alkoxy-groups into the aldehyde or into the base so improves the dyeing power of the product that it can be employed for textile purposes. By using anisaldehyde, 2-4-dimethylhydroxybenzaldehyde, and unsubstituted aldehydes such as cinnamic aldehyde, colouring matters (basic) having relatively good fastness to light, washing, and acids have been obtained.

Hypotheses of Desensitisation

Various hypotheses have been advanced to account for and explain the phenomenon of desensitisation, but none of them rests on a sufficiently secure foundation to warrant unreserved acceptance. The action of the dyestuffs here is not comparable with that of a coloured screen, since solutions of phenosafranine, for example, allow the red and the violet to pass, but desensitise plates and films for these regions of the spectrum. The violet safranines, moreover, act on both ordinary and panchromatic plates like the red safranines, although the absorption spectra of these two colours differ considerably. Finally, there are very active desensitisers which are not coloured. The phenomenon, therefore, does not appear to be exclusively of a physical nature.

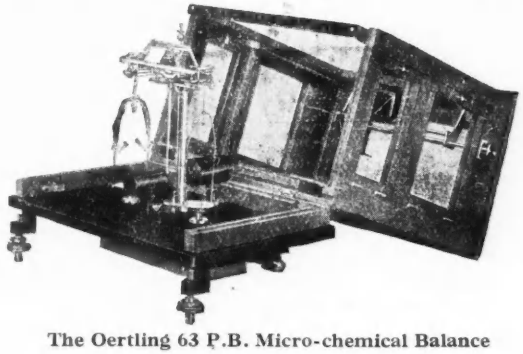
Lumière and Seyewitz have contended that the gelatin silver bromide compound forms with the colour a complex with little sensitivity to light, which may be destroyed by prolonged washing, just as has proved to be the case with phenosafranine. After washing, the preparation reassumes its initial sensitivity. This revival, however, is not common to all desensitisers. Cramer attributes the decrease in sensitivity to an oxidation phenomenon, basing his theory on certain experimental evidence concerning the photochemical oxidising action possessed by desensitisers. This is, more or less, in line with a theory of another worker (Kögel). Cramer attributes a direct oxidising action to the silver halide, while Kögel ascribes to it an indirect one. The hydrogen activated by exposure to light of the silver halide can no longer reduce the silver salt; the easily hydrogenated desensitiser absorbs the hydrogen, giving rise to a leuco base in the case of dyestuffs.

Micro-Chemical Balance

An Accurate British Model

THE rapid development of micro-analytical technique has been accelerated by war-time conditions, with consequent heavy demands for micro-chemical balances. Oertling's, one of the foremost producers of this equipment in Britain, have evolved in their model No. 63 P.B. a particularly accurate balance. Given good balance-room conditions, constant readings to .005 mg. can be obtained. The design has been perfected by experience gained over nearly a century and by the co-operation of leading micro-chemists with the manufacturers.

The beam is 5 in. long and constructed of nichrome; the capacity is 10 gms.; and the sensitivity .001 mg. per half division on the direct-reading illuminated balance. An accurately divided graticule is attached to the end of the pointer



The Oertling 63 P.B. Micro-chemical Balance

and illuminated, and the magnified image is projected on to a screen at the top of the balance case. The rider slide is of a vertical type, graduated from 1 to 10 with 100 divisions and a specially shaped 5 mg. rider to fit the serrated bar which is on the same plane as the knife-edges.

So much for specifications; the chief difficulty remains, namely, how to obtain accurate results when measuring to a 1/1000 mg. by overcoming the interference due to convection currents, air moisture, vibration, etc. With a view to correcting these adverse influences, the upper part and the beam of the balance are separated from the operating chamber by a glass partition which minimises the effect of eddy currents.

Orders from abroad for the high-grade phosphate rock produced in the mines of Curaçao, Dutch West Indies, have led to the reopening of these mines, with a staff of 350. The large stocks in hand which had led to the war-time closing of the mines are now approaching depletion.

Annual Report of I.C.I., Ltd., for 1940

Great Export Effort—Heavy War Reserves Essential

THE annual report for 1940 of the directors of Imperial Chemical Industries, Ltd., to be submitted at the fourteenth ordinary annual general meeting on May 29, records, as a result of war-time conditions, two changes in company procedure: a reduction in the size of the report and the practice of circulating with the balance sheet the chairman's address to stockholders, in order to overcome the difficulties presented to them in attending meetings.

Lord McGowan, the chairman, in his statement to shareholders, points out that, with the intensification of the war effort, the various Government departments had made increasing calls upon the services of members of the board, to all of which they had been able to respond. This necessitated certain alterations in the higher organisation, more especially in the Management Board and the Executive Committees.

Increased Home Trade Demands

"In the home trade," Lord McGowan continues, "the war has been the source, direct or indirect, of ever increasing requirements for nearly all our products and in general the company's factories at home worked to full capacity during the whole of 1940. In particular we had during the year to meet increased demands owing to the reduction or cessation of competing imports, to the necessity to expand agricultural production at home and to the fact that many of our goods are of direct importance in the manufacture of war material. One effect of the closer Government collaboration with industry which the war has necessitated is that it has brought us more intimately in touch with various Government departments. At all times our relations with them have been characterised by a spirit of helpfulness on the part of the Government, whilst on our side the company has striven to do its utmost in a period of mounting pressure."

They were able in 1940 to continue the price policy described at the last meeting for their main products almost up to the close of the year. But the growing pressure of rising costs outside their own control then forced them to advance certain prices in the home trade and to warn customers that they might have to make further increases at intervals during the present year. Customers expressed their appreciation of the policy followed and their gratitude at the efforts made to meet their requirements. Present circumstances forbade him to illustrate in any detail the progress of their manufacturing activities.

War-time conditions presented new problems affecting the company's activities overseas. Export trade had not been neglected. This branch of business is still of great national importance, for it furnishes purchasing power to pay for imported materials vital to the war effort. They had had to meet the difficulties of irregular shipping facilities and progressively more severe exchange control, while the demand abroad for the company's products in many cases increased owing to the cessation of supplies from enemy sources. The practical steps taken by the Government to foster export trade, notably the organisation of the Export Council and Export Groups, the extension of export credit facilities and the establishment of the United Kingdom Commercial Corporation, proved of great assistance in this sphere.

Empire Developments

The main manufacturing subsidiary or associated companies in the British Empire—Imperial Chemical Industries of Australia and New Zealand, Ltd., Canadian Industries, Ltd., and African Explosives and Industries, Ltd.—continued to prosper and expand, and their relations with their respective Governments grew closer and closer. In sympathy with the urgent necessity in war conditions for local sources of supply, they were continuing to expand their own manufacturing capacity, and undertaking fresh tasks for their own Governments and ours, while doing all they could to help in the establishment of new factories for war purposes. These companies had also been of very material assistance in export trade, since in certain directions urgent needs at home interfered with the company's ability to supply from their own works and the overseas companies enabled us to maintain markets by meeting the demand from their factories. They were also greatly indebted in this respect to Messrs. E. I. du Pont de Nemours of Wilmington, U.S.A.

Research in the company's laboratories during 1940 was largely directed to efforts to assist the better prosecution of the war. In addition to service requirements, manufacture of products either to replace those previously imported or to supply new demands under war-time conditions and the development of new products for sale to export markets involved considerable research in devising processes to make use of available raw materials. The agricultural research station was co-operating with the Government on various problems related to the increase of domestic food production including the national silage campaign. Considerable progress was being made on a process for the production of feeding stuffs from straw for cattle.

The Consolidated Accounts

The consolidated accounts show the combined assets and liabilities of Imperial Chemical Industries, Ltd. and 111 subsidiary companies. Audited accounts of certain subsidiaries are not available for consolidation; six of these, situated in enemy or enemy-occupied countries, have each a written down book value of £1.

The total gross income shown in the consolidated income statement is £18,375,000 compared with £15,343,000 for 1939. This increase of £3,032,000 is chiefly due to additional manufacturing and trading profits brought about by the larger volume of business. Net consolidated income declined from £7,678,000 to £6,756,000, a fall of £922,000. The factor which almost alone turned an increase of £3,032,000 in gross income into a reduction of £922,000 in net income was the charge for taxation shown on the statement. The net taxation burden to be borne by the company and its subsidiaries was £7,385,000 against £3,654,000 in the previous year, an increase of £3,731,000. The increased taxation charge was in the main on account of heavier provision for Excess Profits Tax. The average rate appropriate to excess profits for the calendar year 1940 was 90 per cent. against 45 per cent. for 1939. For 1941 it will be the full 100 per cent., although owing to the concession made by the Chancellor of the Exchequer in his recent Budget, 20 per cent. of net tax paid at the 100 per cent. rate will be repaid by the Government after the war under certain conditions.

Although the chairman said that he fully believed in maximum taxation as a vital necessity in the present war economy and had never been amongst those who have cavilled at an E.P.T. rate of 100 per cent., yet he foresaw difficulties and disadvantages in the continuance of such a rate. The most important of these—and the concession just mentioned does not afford any relief—arose in that the taxpayer was obliged to hand over the whole of his excess profits in cash while such profits were certain to be locked up to a great extent in increased stocks at higher price levels and in the larger book debts which of necessity accompanied expansion of business. Stringency in supply of liquid capital thus occasioned, apart from its detrimental effect on the smooth running of any kind of business, might well have a serious consequence in the hindrance of natural and possibly nationally beneficial development. Again, this rate of 100 per cent. did not enable the taxpayer to provide adequate depreciation on capital expended in the national interest on purely wartime projects.

The company's total reserves and carry forward amounted at December 31, 1940, to £21,147,000, an increase of £3,000,000 over the corresponding total last year.

POLYAMIDES

A Note on the Origin of Nylon

The "Views and Reviews" of Dr. Philip Schidrowitz, which appear weekly in the "India-Rubber Journal," are well known in the rubber industry. In a recent issue (I.R.J., 1941, 18, pp. 322/3) his remarks were of so wide and general an interest to the chemical trade that, by courtesy of the author and of the editor of the "India-Rubber Journal," we are reprinting them herewith.

IN his recent paper on "Nylon as a Textile Fibre," Mr. G. F. Hoff, of the du Pont Corporation, mentioned that "nylon" was a generic name, implying "synthetic-protein-like-polymeric amides." Now the birth of a new idea or departure which promises to be of something more than ordinary importance, is a most fascinating subject. So I have been delving in the Patent literature, and I have come across two British Specifications which may, very likely, in good time come to be regarded as something of a landmark in the patent field. I refer to Nos. 461,236 and 461,237, both originating from the du Pont organisation, and both bearing the Application date, May 9, 1935. Incidentally, the Specifications were also accepted on the same day, namely February 9, 1937. Although both these patents deal with polyamides, the first bears the title, "New Compositions of Matter," whilst the second is on "The Manufacture of Polyamides." While No. 461,236 comprises the production of polyamides by heat treatment, etc., of certain monoaminocarboxylic acids (A), No. 461,237 relates mainly to the products obtained by heat-treatments, etc., of the *constituents* of (A), *i.e.*, of certain diamines and certain dicarboxylic acids (*cf.* below for details). In other words—as I read the Specifications—one can obtain the desired "polyamides" either by treatment of certain aminocarboxylic acids (A) or by treatment of the constituents from which the latter are formed (B). Naturally (B), other things being equal, would be the simpler process, technically speaking. If I am wrong as regards my interpretation, or rather reading, of the Patents, I hope that I may be duly corrected by the Patentees.

The subject of "super" synthetic fibre-forming materials is so vastly interesting and important, that I venture to deal in some little detail with the two Specifications which appear to give a picture of the origin of "nylon." In the preamble to No. 461,236 it is stated that: "It is known that certain amino acids can be caused to react with themselves with the formation of polyamides. Thus, the simplest amino acid, glycine, is converted at a high temperature to tetraglycilglycine (Ber. 371,279). Similarly, 6-aminocaproic acid and 7-aminoheptoic acids have been converted to linear polyamides . . . *None of these polyamides, however, were condensed or polymerised to such an extent that they could be drawn into useful fibres.* "*The object of this invention,*" say the Patentees, "*is to provide a practical method of preparing products from amino acids which products are capable of being drawn into useful fibres or formed into sheets, etc.*" (Note.—The italics throughout are the author's).

Claims Covering Various Methods

Claim 1 of the invention (*abbreviated*) reads: "A process which comprises subjecting . . . monoaminocarboxylic acids having amino and carboxylic acid radicals attached to the carbon atoms that are remote from each other and contain no substitution groups other than hydrocarbon radicals, or . . . (*various alternatives*) . . . *to heat treatment for a time sufficient to form a product which is capable of being drawn into continuous filaments . . . and hereafter elongating or cold drawing said formed filament . . . by the application of a moderate stress,* preferably at ordinary temperatures. There are 19 claims in all covering various methods, etc., but it may be sufficient to refer to two or three. Thus No. 2 refers to a process as in Claim 1 in which the heat treatment is continued until the intrinsic viscosity (*defined*) has increased to at least 0.4. In Claim 8 the carrying out of the process at a temperature of 150° to 290° C. is claimed, and No. 10 claims "A process . . . in which the unit length of the parent monoamino monocarboxylic acid . . . employed is at least 7."

"The *unit length* (*cf.* ref. to Claim 10 above) of a monoamino monocarboxylic acid (or ester thereof) may be defined as the number of atoms in the chain of that part, called the structural unit, of the formula of the amino acid molecule which remains upon removal therefrom of one amino hydrogen and the hydroxyl of the carboxyl group." For example, glycine $NH_2CH_2.COOH$ has a structural unit—$NH.CH_2.CO$—(*i.e.*, a unit length of 3). Now "the products obtained by the present invention are thought to be built up by recurring structural units which are linked end-to-end in chain-like fashion." Further, "*The unit length of the structural unit* in the product and hence in the present material *has an important effect* on the nature of the product. Finally (*cf.* Claim 10 above) "*The amino acids which yield the desired superpolyamides most readily are those having a unit length of at least seven.*" Examples of unit length:

Unit Length	*Structural Unit*	*Acid*
7	$—NH(CH_2)_5CO—$	$NH_2(CH_2)_5COOH$
12	$—NH(CH_2)_{10}CO—$	$NH_2(CH_2)_{10}COOH$

The 12-unit length product is prepared by the action of ammonia on co-bromoundecanoic acid.

(Note.—The *super*-polyamide is a synthetic linear condensation product capable of being formed directly into useful fibres, as distinguished from the low molecular weight polyamides which are not.)

An Example of a Superpolyamide

Superpolyamide $(—(CH_2)_8COONH—)_x$ = Unit Length 10, is obtained when 10 parts of 9-aminononanoic acid, $NH_2(CH_2)_8COOH$, and 12 parts of mixed xylenols (as solvent) are heated in a slow stream of nitrogen at 215° C. After about 20 minutes the visible distillation of water is complete, and heating is then continued for 2 hours at ordinary pressure. The pressure is then gradually reduced to 5 mm., whilst the xylenol is completely distilled. The residual superpolyamide is "a hard, opaque, very tough mass of intrinsic viscosity of about 0.65." This can be spun to filaments of good quality by extrusion under N pressure of 8-10 lb. from a spinneret (orifice 0.47 mm. dm.) maintained at 210° C. The extruded filament is reeled up and simultaneously "cold drawn" to produce an extrusion of 286 per cent. The maximum extrusion under these conditions, for this superpolyamide, is about 500 to 600 per cent. "The completely cold-drawn filaments are exceptionally strong, tough, pliable and lustrous, and are permanently oriented, as shown by a typical X-ray fibre diffraction pattern" "The fibres generally have a tensile at break of 3 to 4 gm/denier."

In Specification No. 461,237 certain diamines and certain dicarboxylic acids [or amide-forming derivatives of dicarboxylic acids (A)], are reacted, either directly or in the presence of solvents. The diamines are such as have at least one hydrogen attached to each nitrogen atom, and the reactants are preferably in approximately equi-molecular proportions. The diamines and acids are such as are free from unsaturated aliphatic linkages, and are so selected that the sum of their radical lengths is at least 8. Dicarboxylic acids or (A) having a radical length of 4, as well as diamines of a radical length of 5 and diamines of radical length 4 containing an amino group attached to a secondary carbon, are excluded. The reagents are "heat-treated for a time sufficient to form products which are capable of being drawn into continuous filaments." The reaction may be controlled by viscosity and

conductivity measurements. There are 27 claims in all covering the dominating features of the process, details of operating methods, temperature range, catalysts, specific character of reactants, treatment of products of reaction, etc. There are 7 separate examples (describing reactions with and in the absence of solvents). Example 3, relating to the reaction between pentamethylenediamine and sebacic acid, is subdivided into 8 separate experiments showing variations in procedure and quantities and the like. The product has the formula $(—NH—(CH_2)_5—NH—CO—(CH_2)_8—CO—)_x$ and has a unit length of 17. The general reaction of the process may be figured as follows: $x\ (HOOC—R—COOH) + (H_2N—R_1—NH_2)x = (—NH—R_1—NH—CO—R—CO)_x \ldots + (H_2O)_x$.

According to the Patentees, if a large excess of diamine is used, the product will consist largely of a *monomeric* substance: $NH_2.R_1.NH.CO.R.CO.HNHR_1.NH_2$. Similarly, if a large excess of acid is employed, a short molecule with acid end groups will characterise the product. A relatively small excess of diamine may result in a product having relatively long molecules bearing amino groups at each end. "Theoretically an exceedingly long molecule has to be derived from almost exactly equivalent amounts of acid and amine, but in practice a small excess say 5 per cent. of diamine or acid may frequently be used to advantage to take care of any diamine or acid that is volatilised."

Properties of a Typical Product

In exemplification of the properties of fibres produced by the process, the following particulars of a product derived from pentamethylenediamine and sebacic acid (using a slight excess of the former) may be given. Spun and cold-drawn under certain conditions (*q.v.*), the data are as follows: Temperature of melt 215-220° C.; spinning rate (peripheral speed of first drum) 70 ft. per min.; rate of cold drawing (p.s. of 2nd drum) 225 ft. per min.; complete cold drawing of the filament = extension of 444 per cent.; denier at break of resulting silk-like fibre 0.65 g.; tenacity at break 3.38 denier or 33 kg./mm². A fibre of the same superpolyamide of denier 1.1 g., was dried (16 hours) at 110° C. It was then stored at 25° C. at 50 per cent. relative humidity for 5 hours. The moisture absorption = 0.79 per cent. Under comparable conditions viscose fibres absorbed about 8 per cent. moisture. The polyamide also had a higher ratio of wet to dry strength than rayon.

In the above I have attempted, in the merest outline, to give some of the essential particulars of two patents which appear to me to be of basic importance in connection with the "nylon" fibre development. Whilst these particulars may be chiefly of interest to chemists, I hope that they may in many respects be attractive to manufacturers and to all the technically-minded.

Cellulose Fodders

The Search for Substitutes in N. Europe

A PROCESS has been developed in Finland for producing, by a special method of fermentation, a cellulose fodder having a high protein content. Plans, according to *Foreign Commerce Weekly*, have been formulated for an initial output of some 50,000 metric tons. This is only one example of the endeavours of Northern European countries to overcome the shortage of cellulose fodders. Germany herself, faced with a shortage of foodstuffs as a result of the British blockade, is reported to have perfected a protein fodder from wood pulp which is said to offer a satisfactory emergency feed for livestock. Intensive experiments were undertaken in Germany in pre-war years for the purpose of obtaining protein fodder by the sugarisation of wood. Realising the country's dependence upon imported fodder, the German Government contributed considerable sums for subsidising these experiments.

To promote the manufacture of synthetic fodder from wood pulp, the Berlin Cellulose Fodder Co. was recently organised. The concern, which is sponsored by the Government, finances the construction of cellulose-fodder factories. Present plans call for eight plants; construction of the first was scheduled to start early in March. These plants will produce cellulose meal from chemical wood pulp. Mixed with egg white, oats, molasses, and carbonic calcium, this product is reported to provide an effective substitute for the fodders formerly in use. For the present, this type of fodder will be fed only to horses and cattle.

Norway is said to be in a position to produce approximately 100,000 metric tons of cellulose fodder annually as a by-product of its wood pulp industry. Ordinary sulphite and sulphate wood pulp is subjected to a special cooking process designed to increase its digestibility. The resulting product is then mixed with herring meal and other waste from the fish-conserving industry and with root vegetables.

Three new plants have already been built in Sweden for producing fodder cellulose. The method utilised is based upon cooking the wood pulp with soda lye, separation of the wood fibre, and fermentation of the residue. The addition of sugars improves the taste and nutritive qualities of the fermented cellulose for livestock. While this fodder substitute does not contain protein, it is stated to be equal to oats in total nutritive value and is considered especially valuable for mixing with soya cake, molasses, and other materials in the production of mixed fodders, and the Swedish Government is announced to have already ordered a supply of 50,000 tons.

Treatment of Gypsum Ores

Flotation by Cationic Reagents

GYPSUM is far from being a rare mineral, and in many trades that use it, for example the building and cement industries, the purity and colour of the product are of relatively small import. In the glass and ceramics industries, however, a silica-free product is to be desired. In effect, however, the large supplies of high-grade gypsum that are readily available in many parts of the world have discouraged large-scale attempts to concentrate the raw ore by ore-dressing and flotation methods. It is well known that gypsum can be floated free of silica by using fatty acids, fatty-acid soaps, and other anionic reagents, but many ores contain such small amounts of impurities that it would appear a more economic process to reverse the separation and float the impurities off the gypsum by cationic reagents. Less material has to be floated and a single-stage operation gives a finished product. Such has been the study of J. B. Clemmer and F. D. de Vaney, reported in R.I. 3553 of the U.S. Bureau of Mines. Preliminary tests showed that certain cationic reagents floated the gypsum almost as readily as the silica, thus precluding good separation. Laboratory and pilot-plant tests demonstrated, however, that the cationic reagents Emulsol 903-L and DLT 699 could be used to float the silica and colour impurities in gypsum ores, though rather large amounts of reagents were required. Du Pont 243 was an effective silica collector, but also showed pronounced gypsum-collecting properties. Gypsum slimes presented a certain amount of difficulty, which was accentuated by overgrinding, and froths were often voluminous and unduly stable. In order to minimise the quantity of silica collector necessary, attempts were made to improve slime-flotation by mild flocculators, of which diamyl amine proved the most successful. The optimum *p*H was established at 6.5-7.2.

PRODUCTION OF SODIUM SULPHATE from natural brines and saline deposits in the United States increased 36 per cent. in 1940 over the previous record output of 1939. Output of natural sodium carbonates increased 4 per cent., but shipments of borax and other boron derivatives decreased slightly in 1940, according to reports of producers to the Bureau of Mines. Producers of natural salt cake operated at capacity during the year in an effort to replace the supply of salt cake which formerly came from Europe. Large-scale production of "synthetic salt cake," a sintered mixture of sulphur (3 parts) and soda ash (10 parts) was reported from Lake Charles, Louisiana, at the rate of several hundred tons a day.

Chemicals in Australia

Power Alcohol

THE power alcohol committee of Australia is formulating plans to increase production of this fuel, and the Director of Substitute Fuels, Mr. P. C. Holmes Hunt, is arranging to have the entire Australian output of molasses set aside for this purpose. It is hoped, says *The Industrial Australian and Mining Standard* (1941, *96*, 2465, p. 34) that sufficient plant to treat it will be in operation early this year. Economic production of power alcohol from other raw materials, such as sugar beet, potatoes, surplus fruit, cassava, nipa and sago palm, as well as timber, is also being considered. Investigations into production costs show that plant to produce 1,000,000 gal. a year from molasses would cost £100,000.

The production of power alcohol, it is expected, will be doubled this year to 4,000,000 gal. by the total output of the three distilleries operating in Queensland, N.S.W., and Victoria, using molasses as the raw material. Proposals for further increasing the output by distillation from material other than molasses will be recommended by the committee, though whether large-scale production, implying an output of many millions of gallons a year, should be contemplated as a war-time emergency measure has not yet been decided. Petrol interests are believed to be not unfavourable to production of power alcohol for blending with petrol. The amount of protection the power alcohol industry would require has a relation to Government finance, because of the revenue benefits now being derived from customs and excise duties on petrol. Power alcohol produced in Australia is free of excise, and is retailed in Sydney at 1s. 9d. a gallon, which is considerably higher than the retail price of petrol, after allowing for duties —amounting in all to about 11½d. a gallon.

New Sources of Fish Liver Oil

Most of the cod liver oil used in Australia was imported from Norway, and now that this source of supply has been cut off, Australia, in common with many other countries, finds herself short of sources of Vitamins A and D. Vitamin D can be prepared synthetically, but not Vitamin A. Thus it became important to investigate the capabilities of Australia's own fish to supply the oils and the latter vitamin potency. The work was divided between the Fisheries Division of the Council for Scientific and Industrial Research and the Commonwealth Serum Laboratories. The former, says *The Industrial Australian and Mining Standard* (1941, *96*, 2464, p. 21), undertook to study the sources of oils and the latter their vitamin potency.

As a result of this work, which is still in its early stages, it has been found that the Yellowtail is an exceptionally good source of high quality vitamin oil. The livers of this fish produce about ten per cent. of their weight of a light-coloured oil of good flavour which contains about 40 times as much vitamin A and 110 times as much vitamin D as cod liver oil. The extraction of the oil from the livers is easy, so that the only difficulty is the collection of the livers from fishermen. As the value of these livers is high, it should not be difficult to persuade fishermen to collect the livers and place them in jars or casks containing 1 per cent. of formalin by weight. A firm in Melbourne has plant capable of handling the livers and is at present producing a quantity of shark oil which contains as much vitamin A as the Yellowtail, but little vitamin D.

In addition to these sources, it has been found that the "salmon" body oil produced as a by-product of the salmon canning factory at Narooma, N.S.W., has approximately the same vitamin content as cod liver oil, and should be an important substitute for cod liver oil as well as for the pilchard oil which was used for poultry and pig feeding. The offal of flathead from the Sydney fish market has been found to give 3 or 4 per cent. of an oil somewhat better in quality than cod liver oil, and it is hoped that it may prove economical to save this offal. The Fisheries Division is also studying the possibilities of other fish such as mullet, tuna, and barracouta, as sources of high-grade fish oils.

Treatment of Lubricating Oil

The Effect of Inhibitors on Oxidative Deterioration

WITHIN the last few years the addition of sundry agents to lubricating oils has been made with the object of increasing their lubricating effect at extreme pressures, of lowering the "pour-point," of reducing the rate of sludge formation and the loss of viscosity and lubricating effect whilst in operation, and of lowering the rate of corrosion that has been suspected to be one of the main causes of engine wear. Practice, as usual, has tended to outrun theory and explanations of the effects achieved have not always been assured. Work in this field has just been published by Davis, Lincoln, Byrkit, and Jones (*Ind. Eng. Chem.*, 1941, *33*, 339), who have found that the oxidation of lubricating oils in the engine is of an autocatalytic nature, being characterised by an induction period followed by a period in which the products of oxidation, being acidic in nature, attack the engine parts, with the production of oil-soluble metal salts having a strong catalytic effect.

These authors consider that inhibitors may act (1) by prolonging the induction period; (2) by precipitating or otherwise inactivating metallic catalysts as formed; and (3) by reducing the amount of these by the deposition on the engine parts of a corrosion-resistant film. Apparently the standard anti-oxidants such as amines and poly-hydroxy aromatics act only in the manner (1), whereas sulphur-bearing esters of the type of methyl-S-linoleate and the sulphurised olefines derived from petroleum wax act with marked efficiency in all three respects. Presumably the iron content of the oil after standard periods of service may be taken as a useful criterion of the deterioration of the engine, and tests have shown that the addition of a sulphurised olefine to a lubricating oil reduced the final iron content in fairly similar tests to 8.6 per cent. when the estimation was made on the unfiltered oil, or 1.1 per cent. on the filtered oil, percentages being based on the corresponding amount in the untreated oil. Parallel observations of wear showed that it was severe with untreated oil, but apparently absent with the addition agent.

Other addition agents in which metal is intentionally introduced into the oil are described by O. M. Reiff (*Ind. Eng. Chem.*, 1941, *33*, 351). One of these is produced by chlorinating a paraffin wax of m.p. about 52° C. and mol. wt. about 350 and reacting with phenol in the presence of anhydrous aluminium chloride, and substituting, *e.g.*, Co for the Al combined as a phenate in the product. Such an alkylated cobalt phenate acts as a pour-point depressant and also as an oxidation inhibitor, but striking improvements in the effectiveness as pour-point depressant, viscosity index agent and anti-oxidants are claimed to be produced if the alkylated phenols are converted by Kolbe synthesis to phenolic carboxylic acids from which metal salts of the type metal oxide-metal carboxylate are made and solubilised in motor oils with phenolic acid.

It is suggested that the anti-oxidant action is due to decarboxylation of carboxylic acids, formed during oxidation of the oil, which attack the metal parts of the engine with production of oil-soluble catalysts, and also possibly to a directive effect produced by the addition agent towards the formation of oxidation products other than carboxylic acids. Further possible effects are that the metal content of the addition agent assists combustion of deposited carbon and removes some from the piston rings by a sort of detergent action.

THE I.G. FARBENINDUSTRIE in Brazil, which in 1939 imported a three or four years' supply of dyes from Germany, has been investing proceeds from these sales in Brazilian securities; in December, 1939, it bought the caustic soda and chlorine plant at Alcantara. The trend in Brazil continues towards supplying the domestic market from home sources. A plant for making plastics from coffee has been started and another is projected. A caustic soda factory may be established within the next few years by I.C.I., the Solvay Process Co., and American interests. A cellulose and wood pulp plant is being erected in the southern Paranà pine region and is expected to be in operation in 1941.

Chemical Engineering Group

Annual Meeting and Luncheon

THE twenty-second annual meeting of the Chemical Engineering Group, Society of Chemical Industry, was held at the Wadorf Hotel, London, W.C.2, on May 21, with the Chairman, Mr. H. W. Cremer, presiding. The meeting, as last year, was followed by a luncheon, after which Lord Keith, the principal guest, delivered an informal address dealing with certain problems of post-war reconstruction.

The report and accounts for 1940 were presented respectively by the Hon. Secretary, Mr. J. M. Leonard, and the Hon. Treasurer, Mr. F. A. Greene, and were unanimously adopted. The committee reported that membership had been very well maintained, being only three less than at the conclusion of the previous year. The system of holding meetings jointly with the Institution of Chemical Engineers had proved a pronounced success.

It was decided that the hon. officers and members of the committee should remain unchanged for 1941/42; and in conclusion the committee expressed its appreciation of the loyal services rendered throughout the year by the Assistant Secretary, Mr. C. J. T. Mackie, and his staff.

Standards for Lac

New B.S.S. Issued

BRITISH Standard Specification No. 954-1941, published in April, is a remarkably full and detailed specification of the essential requirements for lac, and is the first to be issued dealing with this material. It is priced at 2s. and may be obtained as usual from the British Standards Institution.

The existence of many varieties of lac and of their multiplicity of uses has influenced the form of the specification, which is concerned solely with "whole" natural lac. "Whole" natural lac in this specification means all lac material, whatever its physical form (apart from debris of the lac insect and other adventitious matter) preserved throughout the processing operations to which the material may have been subjected. Later specifications for special types of lac such as "de-waxed" or "bleached" may be prepared, but the committee which has prepared the specification does not envisage such a development at the present time.

A note in the foreward calls attention to the omission of the determination of the Hubl Iodine Value and the inclusion only of the Wijs Iodine Value. World opinion generally is in favour of the Wijs Iodine Value, but many authorities consider that both methods may be used, although they are not simple alternatives. There is nothing in this specification to prevent iodine values being determined by the Hubl method, but as in a British Standard Specification it is desirable to have one test only for the determination of one property of the material, the committee decided that the Wijs test should be used.

Other main heads of the specification include freedom from foreign matter, ash content, and insoluble matter; and among the special clauses are those dealing with tests of flow and heat polymerisation, with volatile matter, colour, and arsenic and lead contents. Appendixes detail the Halphen-Hicks and McIlhiney Tests for the detection and estimation of rosin, the V-tube fluidity test and other necessary operations.

The Starch Molecule

New Studies of its Chemical Composition

A VERY interesting series of papers on the structure of the starch molecule and starch granule, claiming to go far towards the removal of difficulties of interpretation previously encountered, has been abstracted in *J. Inst. Brewing* (1941, *47*, 2, 42-45). Originally published in *Helv. Chim. Acta* (1940, 23, 845-897), the papers are the work of K. H. Meyer and associates, the views described being based on chemical, physiochemical, and biochemical evidence. The conception of chemically distinct amylose and amylopectin is restored to a position of fundamental importance, the former with diastase yielding exclusively maltose from its straight-chain molecule, the latter giving maltose and dextrins from its repeatedly branched or ramifying chains. It must be confessed that these views are of very considerable interest, representing as they do possibly the best attempt so far to clear up the many difficulties of the problem. Not the least important point made is that different starches are not chemically identical in their amylopectin component, but differ in degree of ramification. From the theoretical side, the claimed existence of a number of linkages capable of producing a disaccharide isomeric with maltose, suggests that the somewhat notorious *iso*maltose may yet prove to have a real existence. In view of the fact that the study of starch construction has been proceeding for some 70 years now, without having reached a definite determination, these studies assume an importance beyond the ordinary.

Paint Research in U.S.A.

Experiments with Test Surfaces

AS part of the general research programme on construction materials and methods for low-cost housing, the U.S. Bureau of Standards is studying the behaviour of the special paint used on exterior walls of porous masonry to keep out moisture. A test field has been built where masonry paints can be applied under practical working conditions, after which, according to *The India Rubber Journal* (1941, *101*, 17, p. 2), a careful watch can be kept to determine the effects of exposure. The materials used in constructing the test walls include new and used common brick, cinder block, expanded blast furnace slag block, concrete block, cast-in-place concrete, and cement-asbestos siding. The walls are vertical and face north and south. Commercial brands of oil and varnish paint, emulsified synthetic resin paints, chlorinated rubber coatings, rubber emulsion paints, and cement-water paints have been applied to each type of test surface. The use of cement-sand grout coat as a base on open joint and extremely porous walls, and the efficiency of rubber primers on "green" walls are being given particular attention in the painting procedures and in the study of the compatibility of dissimilar paint coatings. The hiding power and colour of the paints were determined by instruments at the time of painting, and changes in these properties are being followed by monthly measurements made with a portable reflectometer. The spreading rate, brushing properties, drying characteristics, and recoatability were also recorded for each paint on each type of surface. The relative moisture content of the walls at the time of painting, and from time to time afterwards, is determined with a "moisture meter."

Injection Moulding

An Improved Process

DU PONT DE NEMOURS announce developments in the process of "injection moulding" whereby electrical heating, working, and cooling of a granulated solid in a cylinder makes it rigid enough for ejection into certain forms. A heat-stable cellulose acetate makes it possible to produce an inexpensive, heat-stable plastic, which at the same time can be softened by heat. This has caused a large increase in the possible applications of injection moulding. There are five advantages in the new method resulting in lower production costs, but higher quality articles. They include rapid press operation, low moulding cost, greater ease in setting up moulds, a small loss of material and a high thermal efficiency. A variety of articles are being produced by the process which should prove particularly suitable in rubber manufacture, if a technique can be devised whereby the treated rubber will vulcanise completely and rapidly after injection into a moulding die.

Personal Notes

MR. H. J. HUTCHINSON and MR. G. W. TURNER have been appointed Under-Secretaries in the Ministry of Supply.

MR. J. B. BRIGDEN, secretary to the Munitions and Supply Departments, has been made an Honorary Fellow of Oriel College, Oxford, in recognition of his services to Australia's war effort.

MR. JOHN CHRISTIE, F.I.C., of Mumbles, Swansea, has been appointed a regional assistant director of Ordnance Filling Factories. Mr. Christie was for many years general manager

Mr. John Christie, F.I.C.

of African Explosives Industries, Modderfontein, Transvaal, and was later managing director of Steelite and Porcelain Products, Ltd. He retired from active business in 1939.

OBITUARY

MR. JAMES FREDERICK COPLEY, who died recently aged 67, was managing director of Copley, Marshall and Co., Ltd., and began his career as chemist with a Huddersfield firm.

MR. CHARLES SHARP, who died at Parkstone, Dorset, on May 16, aged 80, was a director of the British Oxygen Co., Ltd., from 1894 until his death. He was one of the signatories to the memorandum of association forming the original Brins Oxygen Company in 1886.

LIEUTENANT J. D. WRIGHT, Royal Canadian Engineers, who was killed in a recent air-raid on London, was a chemical engineer with Imperial Oil, Ltd., Sarnia, Ont., until proceeding overseas. He joined the Army as a private, and transferred to the engineers on receiving his commission in March, 1939.

MR. M. R. F. H. STUART, A.M.I.C.E., A.M.I.Mech.E., who died on May 14 in his 51st year, was London manager and commercial manager of Davey Paxman and Co. (Colchester), Ltd., engineers and boilermakers. He joined the firm in 1908. He was attending last week's meeting of the Chemical Engineering Group of the Society of Chemical Industry when he had a stroke; he was taken to St. George's Hospital where he died next morning.

New Control Orders

Fertilisers (Sales)

THE food production campaign has resulted in an increased demand for fertilisers, and the Agricultural Departments and the Ministry of Supply have under consideration a scheme for more equitable distribution of certain fertilisers during the 1941/42 season. In order to prevent forward sales being made which might prejudice this scheme the Ministry of Supply in consultation with the Agricultural Departments has issued an Order, the Control of Fertilisers (No. 9) Order, which came into force on May 19, 1941. This Order limits forward sales of superphosphate and potash, and compound fertilisers containing superphosphate or potash, except under licence. Manufacturers and wholesale distributors may not sell for delivery after June 30, whilst retail distributors may only sell for application to the land by the buyer before July 1. Applications for licences to sell except as above, which will only be granted in very special circumstances, can be made to the Fertiliser Control, 19 Berkeley Square, Bristol, 8.

Copies of the Order (S.R. & O. 1941, No. 683) can be obtained from H.M. Stationery Office, York House, Kingsway, W.C.2, or through any booksellers.

Sulphuric Acid

The Minister of Supply has issued Direction No. 3 (S.R. & O. 1941, No. 661) under the Control of Sulphuric Acid (No. 2) Order, 1940, revoking Direction No. 2. From May 16 the basic prices for battery, accumulator, or reagent acid are increased by 25 per cent.; for acid 136°-144° Tw. by 27s. per ton; for 92-96 per cent. acid by 33s. per ton; for 98 per cent. acid by 34s. 4d. per ton; for acid with 17-25 per cent. free SO_3 by 36s. 6d. per ton; and for all other acids at the rate of 27s. per ton for 77 per cent. acid and pro rata. Provisions for delivery costs and demurrage on tank waggons are maintained (*see* THE CHEMICAL AGE, 1940, *42*, 1088, p. 261).

A CHEMIST'S BOOKSHELF

PRACTICE OF ORGANIC CHEMISTRY. 3d. Ed. By Homer Adkind, S. M. McElvain and M. W. Klein. London: McGraw-Hill Publishing Co., Ltd. Pp. 294. 17s. 6d.

This book is the 40th volume published in the International Chemical Series since it started in 1911. It contains discussions, with numerous illustrative preparations, on the more important fundamental classes of organic reactions and certain important mechanical operations which are necessary for the utilisation of these reactions. A group of fifty well chosen experiments elucidate the text and each of the fifteen chapters of the book ends with a number of questions aiding advanced students to recapitulate the various subjects. Although the book deals chiefly with the preparation of pure and representative organic compounds it is also partly devoted to qualitative and quantitative analysis and to precautions to be taken in organic laboratory work. One chapter refers to the literature of organic chemistry, mainly to the comprehensive works of Richter (Lexikon der Kohlenstoffverbindungen) and Beilstein (Handbuch der Organischen Chemie), both of which cover the wide field of organic chemistry and arrange its innumerable compounds in orderly fashion. Many other important books and such valuable sources of reference as periodicals and abstracting and reviewing journals are dealt with in this compilation. The book, which also contains many figures of the apparatus employed, will prove most useful to students and helpful to teachers.

DILATOMETER FOR HEAT-SENSITIVE MATERIALS

In a dilatometric investigation of the crystallisation of rubber at low temperatures described by Bekkedahl and Wood (*Ind. Eng. Chem.* 1941, *33*, 381) a simple type of sealed bulb dilatometer was used and sealing after introduction of the rubber test piece was effected in the following manner. The calibrated capillary tube was sealed to a wider glass tube and the specimen introduced into the open end of this. The tube was sealed without overheating the rubber and without leaving a large free space, by the simple device of inserting a small sealed bulb (of the same type of glass and making a good fit in the wider tube) into the open end and sealing off over the outer end of this small bulb.

General News

IMPERIAL CHEMICAL INDUSTRIES, LTD., and Lever Bros. and Unilever, Ltd., have each handed £750,000 to the Lord Mayor, to be invested in connection with London War Weapons Week.

AS FROM JUNE 1 RAYON YARN prices are to be increased. Viscose yarns will be raised 3d. to 56d., acetates 4d. to 55d., and Bembergs 4d. to 55d. per lb.

A CONTROLLER OF FACTORY AND STORAGE PREMISES for the Midland Region has now been appointed by the Board of Trade, completing the list given in our issue of May 3 (p. 253). Mr. A. D. Carmichael is the new Controller, with headquarters at 40 Summer Row, Birmingham.

FACTORY FORM 2000, being a certificate of exemption for danger buildings of explosives works from the Factories (Standards of Lighting) Regulations, 1941, has been issued by the Ministry of Labour and National Service (price 1d., post free 2d.).

A CONSOLIDATED ORDER, giving a full list of the goods the exportation of which from the United Kingdom is controlled under the Export of Goods (Control) (No. 19) Order, 1941, has been published by H.M. Stationery Office, (price 6d.), showing the position on May 15, 1941. It includes an alphabetical list of the various articles affected.

THE MINISTER OF FOOD has made an Order, to come into force on June 2, prohibiting, except under licence, the manufacture or sale of Vitamin C. The Order does not apply to the manufacture or sale of Vitamin C for medicinal, pharmaceutical or scientific purposes. Applications for licences should be made to the Ministry of Food, St. John's College, Oxford.

A NEW PRODUCT can be produced by chemical manufacturers who have dehydrating plant, dryers, and grinding plant. Messrs. John Miller and Co. (Aberdeen), Ltd., of Sandilands Chemical Works, have co-operated with the Aberdeen city cleansing department in salvaging food waste and converting it into a food fit for poultry, cattle and pigs. The waste is charged into dehydrators and later discharged in the form of a meal on to conveyors. Then it passes under a magnet in order to remove impurities, is powdered to a fine grain, and packed. So far 100 tons of meal have been turned out.

A PUBLIC SYMPOSIUM ON THE RELATION of the chemist to the works was held under the auspices of the Society of Chemical Industry at Newcastle-on-Tyne on Thursday last week, dealing with a matter of supreme importance at the present time. Dr. Parke discussed the research department in a heavy chemical works; Mr. Priestley dealt with the chemical division in a soap and edible-fat factory; and Mr. Muddiman described the chemist's part in the coal industry. Their general thesis was how, by the use of hitherto discarded material, as well as by new processes, the chemist had an increasing influence on the national effort and the well-being of the community.

THE BOARD OF TRADE HAS ISSUED the Trading with the Enemy (Specified Persons) (Amendment) (No. 7) Order, 1941. It contains a number of additions to and a few deletions from the previous lists of persons and firms in neutral countries with whom trading is illegal. Additions of chemical interest include: Cekace Pharmaceutica, Ltda., and Laboratorio Esculapio, Ltda., both of Rua da Alfandega 144, Caixa Postal 1912, Rio de Janeiro, Brazil; Quimica Schering Ecuatoriana S.A., Calle Chile 309, Guayaquil, Ecuador; Nacional Drogas Express S.A., Abraham Gonzalez 64, Mexico City; Benzinho, Ltda., Estrada de Vizo, Caixa Postal 14, Setubal, Portugal; Drogaria Luso-Indiana, Panjim, Nova Goa, Portuguese India; Laboratories E.F.E., Menendez Pelayo 10, Seville, Spain; and Merck Oficina Cientifica, Apartado 1486, Caracas, Venezuela.

Foreign News

EXPORTS OF MANGANESE from Brazil in February amounted to 44,390 long tons, an increase of almost 71 per cent. over January shipments.

SPEAKING AT SCHENECTADY last week, Mr. Kenneth Farrell, the food chemist, said, according to an Exchange message, that even if shipping were unable to reach Britain it would be possible for the dehydrated food industry to ship enough supplies by plane to feed every man, woman and child in Britain. He calculated that 300 bombers could supply one day's food.

From Week to Week

GUM EXPORTS FROM THE Anglo-Egyptian Sudan last year were £E680,969 as against £E711,558 in 1939.

TANNIC ACID and gallic acid, of both commercial and pharmaceutical qualities, are now manufactured in India from home-produced raw materials.

AN INCREASE OF 27 PER CENT. for 1940 over 1939 of chemical imports into the Philippines is reported. Fertiliser imports showed a special improvement, being nearly trebled in value.

THE U.S. GOVERNMENT has purchased, as part of the defence programme, 300,000 tons of nitrates from Chile; 235,000 tons of copper have also been bought, mostly from the same country, in addition to one-half of Bolivia's tin output.

IN FUTURE THE USE OF ALUMINIUM in Australia will be restricted to defence and essential purposes. Import licences will not be granted to manufacturers of non-essential goods. This follows the rapid development of the Dominion's aeroplane industry.

A PATENT (U.S.P. 2,233,973) for slowing down the setting of cement by adding sodium hexametaphosphate has recently been credited to T. H. Dunn, of Tulsa, Oklahama. This will be of value in the lining of oil wells where it is essential for the cement not to set until it reaches the proper depth.

A TEXAS CHEMIST, C. G. Rook, has found that the cotton burr and stalk, hitherto discarded, can be used as a raw material in the manufacture of an efficient fireproof insulating material. In the manufacturing process the raw materials are treated with gypsum. The product is then pressed into blocks after being mixed with water, and sets in a few minutes.

A COUNCIL FOR THE DISSEMINATION of scientific knowledge throughout the Soviet Union has been formed by the Academy of Sciences of the U.S.S.R. The new council will arrange courses of lectures on the latest achievements of science and on the life and work of outstanding Soviet scientists. It will also publish popular works on scientific subjects.

IMPORTS OF CHEMICALS, fertilisers, and pharmaceuticals into the whole of China in 1940 were valued at 31,918,000 Customs gold units, of which Japan supplied one-third, the United States one-sixth and Germany one-twelfth. German chemicals dominated the Chinese market for years, but during 1939 supplies from Japan equalled Germany's share of the trade and in 1940 were far greater.

A SUCCESSFUL TRIAL RUN of 7457 miles by a motor car equipped with a gas generator using peat as fuel, is reported from Belorussia (White Russia), an area that possesses large reserves of peat, but has no petroleum. The main obstacle to the successful development of a suitable gas generator was the high ash content of peat, which was finally overcome by the designing of a special swinging grate. The consumption of peat is less than 2 lb. per mile.

THE COMMONWEALTH GOVERNMENT of Australia has commandeered virtually all mica in the Northern Territory, the only part of Australia in which this mineral is produced in commercial quantities. Owing to the lack of supplies of mica from India, consumers are now dependent on domestic deposits. Export from Australia is prohibited without the consent of the Commonwealth Department of Supply and Development. Under the present order an officer of the Northern Territory, who will be given power of control for the Government, will purchase the mica at prices fixed by the Commonwealth Prices Commissioner, supervise grading, and arrange transportation from the mines to the nearest railhead in Central Australia. All purchases will be made through the Government representative.

Forthcoming Events

THE 31ST ANNUAL MAY LECTURE of the Institute of Metals will be delivered by Dr. F. Simon, Reader in Thermodynamics at Oxford University, at Oxford on May 28 at 3.30 p.m. in the Clarendon Laboratory. The title of the lecture will be "The Significance of Low Temperature Research." It will deal with Dr. Simon's own experimental work in the last few years on the properties of matter at the very lowest temperatures. Cards of invitation can be obtained on application to the secretary of the Institute of Metals, 4 Grosvenor Gardens, London, S.W.1

Company News

Lewis Berger & Sons, Ltd., announce an interim dividend of 2½ per cent., less tax (last year 6 per cent.).

P. H. Galloway, Ltd., announce a net profit for the past year, after tax, of £20,133 as against £22,551, and have declared a dividend of 10 per cent., as against 11¼ per cent.

Chilean Nitrate and Iodine Sales Corporation will pay half-yearly interest on its 5 per cent. sterling income debentures through Glyn, Mills and Co., on June 30, at 2½ per cent., less income tax.

The British-Borneo Petroleum Syndicate, Ltd., have announced for the year ended March 31, a net profit of £61,774, as against £54,678, and have declared a final dividend of 5 per cent. (15 per cent.) and a bonus of 5 per cent.

Smith and Walton, Ltd., Hadrian Varnish Works, Haltwhistle, have increased their nominal capital beyond the registered capital of £30,000 by the addition of £20,000, divided into 20,000 6 per cent. cumulative preference (not redeemable) shares of £1 each.

The Rio Tinto Company, Ltd., announces a net revenue for 1940, after debenture allocation, of £139,643, against £139,150. After allowing for the preference dividend a balance of £568,113 is carried forward.

B. Laporte, Ltd., announce a net profit of £101,989 for the year ended March 31 (£105,541). A final ordinary dividend of 10 per cent. is recommended, making 15 per cent. (same); also 7½ per cent. on new ordinary shares; and £36,183 is carried forward (£30,546).

New Companies Registered

Frome Plastics, Ltd., (367,131).—Private company. Capital: £500 in 500 shares of £1 each. To carry on research and development work in connection with the manufacture and application of rubber, rubber compounds, synthetic rubber, plastics, paints, pigments, etc. Directors: W. H. Chatfield; Edward Edwards. Solicitors: Allen and Overy, 3 Finch Lane, E.C.3.

Richard Bolton & Co., Ltd. (367,078).—Private company. Capital: £100 in 2000 shares of 1s. each. Manufacturers of and dealers in ore, metals, alloys, silica, manganese metal powders, and other mineral or chemical substances, etc. Directors: Louis A. Hart; Hy. Risner; Edward Ummen. Solicitor: L. A. Hart, 44 Brook Street, W.1.

Imperial Chemical Industries (Turkey), Ltd. (367,156).—Private company. Nominal capital: £7500 in 7500 shares of £1 each. General merchants and traders in and with Turkey, Cyprus, Iraq, Iran, and other countries in the Near and Middle East, and concessionaires or agents for the sale in such territories of any products manufactured or dealt in by Imperial Chemical Industries, Ltd. Directors: Samuel Leigh; Kenan Abdi Sesbes; Alec E. J. Gawler; Michael Naamini Lubin. Solicitor: E. A. Bingen, Nobel House, Buckingham Gate, S.W.1.

Chemical and Allied Stocks and Shares

WITH main interest in the City centred on the London War Weapons Week, business in the stock and share markets has remained very moderate. Nevertheless, the general tendency was steady in the absence of selling, and individual features of interest were not lacking, sentiment having been assisted by satisfaction with the financial results of important companies which have come to hand recently.

Imperial Chemical were firm around 30s. 9d., and the 7 per cent. preference units changed hands up to 34s. 6d. The full figures for the past year and the chairman's statement accompanying the report created a good impression in the City, where the view prevails that there seem reasonable possibilities of the dividend being kept around 8 per cent. during the period of the war. The assumption is that, owing to war requirements, the factories of the I.C.I. group are likely to continue to work to capacity, while at the same time it is clear from the chairman's remarks that everything possible is being done to maintain export trade. B. Laporte ordinary shares have continued to be quoted at 60s., aided by the repetition of the dividend at 15 per cent. Moreover, Lever & Unilever improved from 20s. 3d. to 21s. 9d., on further consideration of the past year's results. The units of the Distillers Co. improved from 63s. 6d. to 64s. 9d., in response to current market dividend estimates, and United Molasses remained at 23s. 9d., and Borax Consolidated were again 28s. At 32s. 6d. Fison Packard were unchanged, awaiting the interim dividend decision, due shortly, but in this case it did not appear that the quotation was adequately tested by dealings.

British Glues 4s. shares changed hands around 5s. 6d., awaiting the financial results, expected next month. British Drug Houses were again 22s. 6d.; the dividend announcement is imminent. Monsanto Chemicals 5½ per cent. preference also remained at 22s. 6d., and Greeff-Chemicals 5s. units have changed hands around par. At 68s. 9d. Turner & Newall were well maintained on balance, and elsewhere, Barry & Staines became firmer at 27s., pending declaration of the dividend. Nairn & Greenwich were again 52s. 6d., while Wall Paper Manufacturers deferred units held their recent improvement to 21s. 9d., though Lewis Berger moved down to 37s. 6d., on the reduction in the interim payment, which had not been generally expected in the market. Pinchin Johnson, however, were slightly higher at 18s., and British Match were 30s. 6d. Among iron, steel and allied securities, moderate gains were recorded in United Steel, Staveley, and Stewarts & Lloyds. Guest Keen were also inclined to improve, awaiting the preliminary statement for the past year's working. Associated Cement ordinary units became firmer at 51s. 3d., and in other directions, hopes of satisfactory results again led to a fair amount of activity in British Plaster Board 5s. shares, which were quoted at 14s. W. J. Bush ordinary shares, which are firmly held and do not change hands frequently, continued to be quoted at 40s.

Among other securities, Boots Drug 5s. ordinary units continued in rather larger demand, and at 36s. 3d., showed a further small gain, pending the forthcoming results. Timothy Whites 5s. shares again changed hands around 18s., and Sangers were 15s. 6d. A firm feature was provided by Murex shares at 82s. 6d., and also by British Aluminium at 39s. 9d., and by British Oxygen at 65s. British Industrial Plastics were quoted at 2s. 9d., but few dealings were shown among smaller-priced shares generally. Leading oil shares moved within narrow limits, and were inclined to be steadier in sympathy with the general tendency on the Stock Exchange.

British Chemical Prices

Market Reports

IN the aggregate there has been a fair movement of industrial chemicals into consumption during the past week, makers deliveries against contracts covering quite good volumes and traders report a moderate volume of fresh inquiry. Values generally are unchanged at recent levels; the undertone, however, remains strong. Among the potash materials offers of yellow prussiate of potash, caustic potash and bichromate of potash are being carefully distributed to approved consumers, and there is a steady request for the technical and pharmaceutical grades of permanganate of potash. Good business is being transacted in the soda section, chlorate, bichromate and yellow prussiate being strong items. Formaldehyde, acetone, borax are all enjoying a good demand. A strong undertone is in evidence in the market for coal tar products, and a fair volume of business has been transacted. Crude carbolic acid, cresylic acid and xylol are active items, and some movement can be recorded in the demand for pyridines.

MANCHESTER.—There has been comparatively little change during the past week in the general conditions of trade on the Manchester chemical market. Actual quotations have shown no important changes compared with last report, though in most directions the tendency is strong. Sellers indicate a moderate volume of inquiry for home consumers and also on export account, and, with a few exceptions, a fair movement into consumption of the soda products and most of the other leading "heavies." With regard to the tar products, active conditions have been reported in most sections and quotations are on a strong basis. Pitch remains dull and featureless.

GLASGOW.—There is no change in the Scottish heavy chemical trade. Home and export business still maintains a slight improvement during the past week. Prices still keep steady and firm.

Price Changes

Cresylic Acid.—MANCHESTER: 99/100 per cent., 2s. 11d. per gal.

Pyridine.—MANCHESTER: 13s. to 17s. 6d. per gal.

Sulphuric Acid.—168° Tw., £8 3s. to £9 6s. 6d. per ton; 140° Tw., arsenic-free, £5 18s. per ton; 140° Tw., arsenious, £5 10s. 6d. per ton. Quotations naked at sellers' works.

The mail from America includes three booklets from the DENVER EQUIPMENT CO., LTD. (U.K. office address, 493A Northolt Road, South Harrow, Middlesex), describing some of their milling equipment of which the Denver Jaw Crusher is an example. An 8 in. by 12 in. crusher has a capacity suitable for 40 to 50 ton mill crushing to 2 in. Bulletin No. F 12-B gives details of the company's unit flotation cell of which 400 have been put into operation since they first appeared on the market in 1932. Similar equipment, the Denver "Sub A" Flotation Machine, is the subject of Bulletin No. F 11-B. This is an individual flotation machine with its own pulp level controlled by a weir overflow.

INVESTIGATIONS MADE UNDER THE AUSPICES of the U.S. Bureau of Mines have led to the conclusion that no appreciable part of the tin required by American industry can be supplied from known domestic sources, no matter how great the stringency nor how high the price. Stock-piling, the discovery of new deposits, and the development of substitutes appear to be the only alternatives for insurance against acute shortage should access to overseas supplies be denied.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Applications for Patents

MANUFACTURE OF DERIVATIVES of α-cyano-γ-acetylglutaric acid.—F. Hoffman-La Roche and Co. A.-G. (Switzerland, March 29, '40.) 4014.

MANUFACTURE OF DERIVATIVES of dihydropyridone.—F. Hoffman-La Roche and Co. A.-G. (Switzerland, March 29, '40.). 4015.

TREATMENT OF MOLTEN MATERIAL.—Holland and Hannen and Cubitts, Ltd., and E. Jagger. 4030.

ACTIVE CONTACT MASSES.—Houdry Process Corporation. (United States, April 10, '40.) 4067.

MANUFACTURE OF METAL LEAF.—A. R. Jahn. 3890.

MANUFACTURE OF MONAZO RED ACID DYE.—A. H. Knight and Imperial Chemical Industries, Ltd. 3858, 3859.

SCRUBBING OF GASES, and materials therefor.—Kodak, Ltd. (United States, Feb. 21, '40.) 3900, 3901.

PROCESS FOR THE PEPTISATION OF SOAP.—A. S. C. Lawrence. 3968.

ELECTRODEPOSITION OF STAINLESS SILVER ALLOY.—Marconi's Wireless Telegraph Co., Ltd., and C. P. Fagan. 3885.

SULPHONATED COMPOUNDS.—National Oil Products Co. (United States, March 23, '40.) 3871.

PREPARATION OF DISINFECTANTS, ETC.—G. Cofman-Nicoresti. 3857.

PRODUCTION OF MOULDING POWDERS.—Shawinigan Chemicals, Ltd. (Canada, March 23, '40.) 3914.

MANUFACTURE OF SALTS of benzenesulphamide derivatives.—Soc. of Chemical Industry in Basle. (Switzerland, March 20, '40.) 3816. (Switzerland, Dec. 16, '40.) (Cognate with 3816.) 3817.

WELDING APPARATUS.—A. H. Stevens (United Engineering and Foundry Co.). (Nov. 27, 39.) 3830.

METHOD OF UTILISATION OF ACTIVATED SLUDGE.—S. N. Stroganov. 4081.

PREPARATION OF SULPHANILAMIDE DERIVATIVES.—Abbott Laboratories. (United States, April 29, '40.) 4863.

APPLICATION OF PHOSPHATE COATINGS to ferrous metal surfaces. American Chemical Paint Co. (United States, April 15, '40.) 4930.

CLEANSING PREPARATIONS.—W. Baird, A. Hill, J. E. G. Harris, S. H. Oakeshott, W. J. Wilson and Imperial Chemical Industries, Ltd. 4839.

ELECTROPLATING OF ALUMINIUM.—A. Borel and H. Webb. 4825.

TREATMENT OF STEEL.—A. Borel and H. Webb. 4826.

DEPOSITION OF METALS, ETC.—A. Borel and H. Webb. 4827.

TREATMENT OF MAGNESIUM.—A. Borel and H. Webb. 4828.

PRODUCTION OF HALOGEN BENZOIC ESTERS.—British Thomson-Houston Co., Ltd. (United States, April 17, '40.) 4964.

MANUFACTURE OF RESINOUS MATERIAL.—A. F. Burgess (Marathon Paper Mills Co.). 4966.

MANUFACTURE OF ALGINIC MATERIALS.—Cefoil, Ltd., and R. C. Rose. 4875.

MANUFACTURE OF HALOGENATED ORGANIC ACIDS.—Distillers Co., Ltd., H. P. Staudinger and K. H. W. Tuerck. 4818.

PLATINUM CATALYSTS.—G. F. Horsley and Imperial Chemical Industries, Ltd. 4892.

MANUFACTURE OF LUBRICANTS.—Imperial Chemical Industries, Ltd. (Du Pont de Nemours and Co.). 4891.

METHOD OF PURIFYING CRESYLIC ACID.—Lever Bros. and Unilever, Ltd. (United States, April 23, '40.) 4834.

PROCESS AND APPARATUS for introducing alloying material into molten metal.—Meehanite Metal Corporation. (United States, Dec. 31, '40.). 4968.

MAGNETIC ALLOYS, and permanent magnets made therefrom.—Mond Nickel Co., Ltd. (United States, April 18, '40.) 4915.

Complete Specifications Open to Public Inspection

RECOVERY OF OIL FROM BONES.—A/B Separator, Lever Bros. and Unilever, Ltd., and B. R. Bostock. Sept. 18, 1939. 4033/40.

PRINTING INKS.—J. M. Huber, Inc. Sept. 20, 1939. 12646/40.

CHEMICAL REDUCING SOLUTIONS, especially intended for use in photographic reversal processes.—Du Pont Film Manufacturing Corporation. Sept. 19, 1939. 13528/40.

CATALYST PURGING.—Standard Oil Co. Sept. 13, 1939. 13835/40.

PROCESS FOR THE MANUFACTURE of hydrated aluminium triformate.—Soc. Normande de Produits Chimiques. Sept. 22, 1939. 15290/40.

MANUFACTURE OF RESINOUS COATING COMPOSITIONS.—Standard Oil Development Co. (Divided out of 31461/39.) Dec. 31, 1938. 3469/41.

Complete Specifications Accepted

APPLYING THIN METALLIC COATINGS.—National Smelting Co., Ltd., H. L. Evans and L. J. Derham. June 20, 1939. 534,888.

PROCESS AND APPARATUS for separating magnesium, beryllium, and other volatile elements from ores or other materials.—D. F. Campbell. June 9, 1939. 534,811.

MANUFACTURE OF PHENYL-ISOPROPYLENE DIAMINE and its derivatives.—P. May (Soc. des Usines Chimiques Rhône-Poulenc). July 7, 1939. 534,815.

RENDERING IRON AND STEEL of improved resistance to corrosion. Pyrene Co., Ltd. (Parker Rust-Proof Co.). July 25, 1939. (Cognate application, 12070/40.) 534,852.

STEEL ALLOYS.—Eaton Manufacturing Co. April 21, 1939. (Cognate application, 23636/39.) 534,893.

ELECTRODEPOSITION OF METALS and metal alloys.—A. R. Thomas and Hutchinson Instrument Co., Ltd. Aug. 16, 1939. 534,818. Aug. 16, 1939. 534,819.

JIGS FOR THE WET SEPARATION OF MINERALS.—H. W. Moir. Sept. 7, 1939. (Convention date not granted.) 534,823.

PREPARATION OF RESINOUS MATERIALS.—W. J. Tennant (Dow Chemical Co.) Sept. 8, 1939. 534,826.

CATALYTIC CRACKING PROCESS.—Standard Oil Development Co. Dec. 29, 1938. 534,856.

EXPLOSIVES.—American Cyanamid Co. Aug. 17, 1939. 534,900.

PREPARATION OF COMPOUNDS OF MORPHOLINE.—Harris-Seybold-Potter Co. April 29, 1939. 534,935.

MANUFACTURE OF AMINONITRILES.—Imperial Chemical Industries, Ltd. Sept. 24, 1938. 534,939.

SUCTION GAS-PRODUCER.—L. W. Bolden. Oct. 11, 1938. 534,858.

PRODUCING OR REFINING OF ALUMINIUM.—Aluminium Co. of America. June 22, 1939. (Cognate application 28267/39.) 534,871.

MANUFACTURE OF NICOTINE.—K. B. Edwards. Nov. 7, 1939. 534,877.

PROCESS FOR THE ALKYLATION OF ISOALKANES.—N. V. de Bataafsche Petroleum Mij. Nov. 22, 1938. 534,876.

IMPROVING THE RESISTANCE OF METALS TO CORROSION.—Pyrene Co., Ltd. Nov. 19, 1938. 534,883.

GAS-PRODUCERS.—J. D. Troup. Nov. 28, 1939. 534,912.

EXTRACTION OF PALM OIL and similar vegetable oils.—A. Nyrop. Dec. 1, 1939. 534,780.

PROCESS OF PREPARING VITAMIN B6.—Merck and Co., Inc. Dec. 27, 1938. 534,916.

VITAMIN B6 BASE and a process for preparing the same.—Merck and Co., Inc. Dec. 23, 1938. 534,917.

TREATMENT OF TAR OILS.—Midland Tar Distillers, Ltd., D. W. Parkes and R. B. Evans. Dec. 29, 1939. 534,798.

CONTENTS

Research in Canada 287

Notes and Comments 288

High-grade Coke from Low-grade Coal—Chemistry in the Forest—Learning in the Levant—Cheaper Sulphanilamide.

Notes from Works Safety Jottings 289

Dyestuffs in the Photographic Industries... ... 290

Micro-Chemical Balance 291

Annual Report of I.C.I., Ltd. 292

Polyamides 293

Cellulose Fodders 294

Treatment of Gypsum Ores 294

Chemicals in Australia 295

Treatment of Lubricating Oils 295

Chemical Engineering Group... 296

Standards for Lac 296

The Starch Molecule 296

Paint Research in U.S.A. 296

Injection Moulding 296

Personal Notes 297

New Control Orders 297

A Chemist's Bookshelf... 297

General News from Week to Week 298

Commercial Intelligence—Stocks and Shares ... 299

British Chemical Prices 299

Inventions in the Chemical Industry 300